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CURRENT LITERATURE

BOOK REVIEWS

Inbreeding and outbreeding

The latest of the series of "Monographs on Experimental Biology" is by EAST and JONES.[1] The book is noteworthy in bringing together in convenient form critical data on an important subject, which have heretofore been neither well organized nor readily accessible. Some will object to certain conclusions, but they enhance the value of the book as a monograph, and all assertions are supported by striking evidence.

Chapter i describes the nature of the problem, discusses its sociological, agricultural, and evolutionary significance, and emphasizes the necessity of proper experiments for its solution. Chapter ii outlines briefly the position of cross-fertilization in the evolution of reproduction in plants and animals. The conclusion is that those organisms which were able to cross with others, at least occasionally, have dominated the organic world. For DARWIN'S negative proposition, "Nature abhors perpetual self-fertilization," a positive substitute is provided in, "Nature discovered a great advantage in an occasional cross-fertilization."

Chapter iii is a very condensed description of the rôle and behavior of chromosomes in plant and animal reproduction. Sex determination and sex linked inheritance are also included, although the reviewer doubts whether these are necessary. Chapter iv presents MENDEL'S law, wisely using a 1:2:1 ratio as the type illustration, linkage, and the factor hypothesis, with particular emphasis on the inheritance of quantitative characters. The rôle of the factor as a mathematical concept, similar to the chemical atom, is ably presented. Chapter v discusses mathematically the effect of various types of inbreeding upon the heterozygosity of a population. Chapter vi presents the inbreeding experiments of CRAMPE, RITZEMA-BOS, WEISMANN, VON GUAITA, KING, ROMMEL, CASTLE, WHITNEY, and A. F. SHULL on animals, and of DARWIN, G. H. SHULL, and of the authors themselves on plants. The emphatic conclusion is that inbreeding is not injurious merely by reason of the consanguinity; apparent evil results are due merely to the isolation of certain recessives.

Chapter vii describes the experiments of KOLREUTER, KNIGHT, GARTNER, NAUDIN, MENDEL, FOCKE, DARWIN, EAST and HAYES, ROBERTS, COLLINS and KEMPTON, GERNERT, and SARGERET on hybrid vigor in plants.

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[1] EAST, E. M., and JONES, D. F., Inbreeding and outbreeding. 8vo. pp. 285. *figs. 46*. Philadelphia: J. B. Lippincott Co. 1919. $2.50.

The results involved increase in size (number as well as size of cells), weight, yield, early flowering, longevity, resistance to climate and disease, seed viability, and ease of vegetative propagation. Foreign pollen immediately produces larger endosperm (maize) than does own pollen in different seeds of the same ear.[2] No selective fertilization in favor of foreign pollen is associated with hybrid vigor.[3] Those characters which are quickest to be modified by external factors also show the greatest degree of hybrid vigor on crossing. On hybrid vigor in animals, which is less noticeable, the work of CASTLE is described, and that of some others briefly mentioned. Chapter viii sketches in historical sequence the theoretical mechanisms which have been provided to explain hybrid vigor, culminating with the junior author's explanation through "dominance of linked factors."[4] The faint possibility of fixing "hybrid" vigor is discussed. Chapter ix discusses the relation of the problem to sterility. Two distinct types of sterility occur: (1) inbreeding may isolate sterile strains in the same way that it isolates other characters; and (2) rather wide crosses may produce a sterile F_1 because through the degree of difference between the uniting germ plasms "the precise and complex machinery governing gametogenesis cannot do its work in the normal manner, and sterility results, although under the same conditions developmental (somatic) cell division goes on as usual."

Chapter x sketches the rôle of inbreeding and outbreeding in evolution. It contains a number of interesting speculations, among which the most striking are that hybrid vigor may be pictured as the efficient cause of the establishment of the sex habit itself, and of the rise of the sporophyte generation in plants. The authors differ from many geneticists in claiming that "bud variations occur much more frequently in heterozygotes than in homozygotes." Chapter xi outlines the value of inbreeding and outbreeding in plant and animal improvements. "There must be cross-breeding to furnish a variety of character combinations from which to select; there must be inbreeding to isolate the combinations desired." The practical utilization of hybrid vigor is pictured also, a fairly common practice in live stock breeding, a rare one in plants other than maize, for which the authors commend a double crossing system.

The two concluding chapters present applications to the human race. Although avowedly less exact than the earlier chapters, these are in a sense the most interesting of all, as may appear in the following summarizing quotations.

"Owing to the existence of serious recessive traits there is objection to indiscriminate, irrational, intensive inbreeding in man; yet inbreeding is the surest means of establishing families which as a whole are of high value to the community. On the other hand, owing to the complex nature of the mental traits of the highest type, the brightest examples of inherent ability have come and will come from chance mating in the general population, the common people so-called, because of the variability there existent. There can be no permanent aristocracy of brains, because families, no matter how inbred, will remain variable while in existence and will persist but a comparatively short time as close-bred strains. But he is a trifler with little thought of his duty to the state or to himself, who, having ability as a personal endowment, does not scan with care the genealogical record of the family into which he enters." "The hybridization of extremes is undesirable because of the improbability of regaining the merits of the originals, yet hybridization of somewhat nearly related races is almost prerequisite to rapid progress, for from such hybridization comes that moderate amount of variability which presents the possibility of the superindividual, the genius. . . . . Further, there must be periods of more or less inbreeding following racial mixtures, if there is to be any high probability of isolating desirable extremes. A third essential in the production of racial stamina is that the ingredients in the melting pot be sound at the beginning, for one does not improve the amalgam by putting in dross."

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[2] JONES, D. F., Bearing of heterosis on double fertilization. BOT. GAZ. **65**:324–333. *figs. 3.* 1918.

[3] BOT. GAZ. **68**:150. 1919.

[4] BOT. GAZ. **66**:70. 1918.

One of the most valuable features of the book is the admirable bibliography of 225 titles.—M. C. COULTER.

NOTES FOR STUDENTS

Temperature and the cobalt chloride method of measuring transpiration.—In the improvement by LIVINGSTON and SHREVE[5] of STAHL's cobalt method of measuring transpiration, one question has remained unanswered, namely, Is it sufficiently accurate to regard the temperature of the slip as it lies on the leaf as being the same as that of the surrounding air? SHREVE[6] has answered this question by making use of a thermo-electrical method for measuring leaf temperatures. This method differs from previous ones in the avoidance of the wounding of the leaf and the resulting temperature complications. Using this method, SHREVE has demonstrated that both in the determination of the index of transpiring power by cobalt slips, and in the standardizing of the slips themselves over a porous evaporating surface, no error results from using the temperature of the air surrounding the apparatus instead of the temperature of the slips themselves.—S. V. EATON.

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[5] LIVINGSTON, B. E., The resistance offered by leaves to transpirational water loss. Plant World **16**:1–35. 1913.

LIVINGSTON, B. E., and SHREVE, E. B., Improvements in the method for determining the transpiring power of plant surfaces by hygrometric paper. Plant World **19**:287–309. 1916.

[6] SHREVE, E. B., A thermo-electrical method for the determination of leaf temperature. Plant World **22**:100–104. *figs. 2.* 1919.

———, The rôle of temperature in the determination of transpiring power of leaves by hygrometric paper. Plant World **22**:172–180. *fig. 1.* 1919.